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ABSTRACT

The ordering of morphemes is examined in group cross-sectional studies of second language learner performance. It is studied in terms of ordering by internal frequency (i.e., the relative rank number of obligatory occasions supplied by the subject) and external frequency (i.e., the native adult frequency ordering of morphemes). There are statistically significant correlations between orders. However, ordering the morphemes by increasing variability attains a statistically significant correlation with the group performance. Yet, when the individual's cross-sectional morpheme accuracy rank orders are compared to internal and external frequency orders, there no longer appears to be such a correlation. When rank-ordering-by-frequency is considered with respect to longuitudinal data on a single individual, the relative accuracy ordering appears not to resemble the frequency ordering. Thus, when the commonly examined morphemes are ordered by grouping the performance data, similarities in orders can be found from group to group in terms of relative accuracy, internal frequencies, and increasing variability. These also parallel native adult orders. However, when the data are ungrouped and individual performance is examined, the individual accuracy orders do not appear to be similar to the ordering of morphemes by relative native frequency. (PMJ)

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EXPLAINING MORPHEME ACCURACY ORDERS: FOCUS ON FREQUENCY

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For several years L_2 researchers have been attempting to explain the rank order of morpheme scores obtained in group cross-sectional studies of second language learner performance (Dulay and Burt, 1974; Krashen, 1976; Larsen, 1975, 1976). Krashen has suggested the order may in part be due to the fixedness of bound morphemes. Larsen's explanation rests on input frequencies to the learner, i.e. on the relative frequencies of these morphemes in native adult speech. In my own work (Rosansky 1976b,c) I have pointed to the possibility that similar rank orders of morphemes across ages and native language backgrounds reported by Dulay and Burt, Bailey, Madden and Krashen (1974), and Larsen, may have been due to artifacts associated with grouping the individual data and ranking the morphemes according to group mean scores. I have suggested that while there are surely commonalities across language learners, the 'invariant orders' reported may be a pseudo-phenomenon. Nevertheless, Larsen's high correlations between native adult frequencies of English morphemes and grouped L_2-learner orders on these same morphemes merit further consideration.

In 1975 Larsen advanced an explanation for the cross-sectional ordering of morpheme accuracy she and other researchers have obtained. In ordering morpheme accuracy for all five of her tasks by modality of the task (i.e. phonic or graphic), she observed a 'top-bottom' effect. That is, some morphemes seemed to be consistently located in the top half of her orderings; and some at the bottom. She observed that: "What separates the group at the top from those... at the bottom is their frequency of occurrence (p. 126)." The rank accuracy ordering of morphemes she obtained on the BSM (Bilingual Syntax Measure) task correlated significantly with the ordering of morphemes in terms of the relative number of obligatory contexts provided by her subjects on that task (Phase I rho=.736; Phase II rho=.745; $p<.05$).

Larsen suggested two possible explanations for these correlations:

1. The morpheme accuracy rankings could have paralleled the number of times the morpheme was supplied (or should have been supplied) because when a subject has more opportunities to attempt production of a morpheme, it may provide for "incremental learning" or
2. The relative frequency rankings of the morphemes (i.e. the relative number of obligatory contexts) may actually reflect normal native adult frequencies "apart from artificial tasks." i.e. "if a subject encountered [in his linguistic input] certain morphemes more than others, he was likely to score better on those morphemes he experienced most often, all other things being equal (p.127)."

To check this second possibility, Larsen chose as an approximate measure of adult frequency (referred to in this paper as external frequency), the frequencies cited in Brown (1973)[1] for the speech of his three L_1 subjects' parents. Larsen found that her rank accuracy ordering of morphemes for the BSM task correlated significantly with the frequency ordering for native adult English speakers (Phase I rho= .71; $p<.05$; Phase II rho =.90; $p<.01$). While she obtained an equally high correlation at Phase II on her Imitation Task, she did not obtain significant correlations on the Imitation Task at Phase I, or on the Listening Task - the other 'phonic tasks' in her study.

After reviewing the differences between the various task demands on the morphemes, Larsen observed that: "It appears ... by looking at patterns among the morphemes, that one way to explain the orderings is to accept frequency of occurrence as their basis (p.138)." Larsen noted that in addition to her rank accuracy order of morphemes, Dulay and Burt's (1974) rank accuracy order of morphemes also correlates with the adult relative frequency ordering (rho =.83; $p<.05$). She concludes that "frequency of occurrence of the morphemes scored would seem to be the basis for the BSM morpheme ordering as well (p.138)."

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I examined the rank accuracy ordering of morphemes from the group cross-sectional data in my own study[2] both in terms of what I've called internal frequency (i.e. the relative rank number of obligatory occasions supplied by the subjects) and external frequency (i.e. the native adult frequency ordering derived from Brown). I also compared my rank accuracy ordering with another variable which might be an explanatory factor - i.e. variability. I chose as a measure of variability the theoretical ranges of the confidence limits around the means obtained for each morpheme. These are displayed in Table 1. The morphemes were then ranked from low (smallest confidence limit) to high.

The group cross-sectional rank accuracy order of morphemes from my data correlates significantly with all three possible orderings of the morphemes: internal frequency, external frequency ordering and the ordering of morphemes by increasing variability. These correlations are summarized in Table 2.

Table 2

Spearman Correlation Coefficients Between the Group Rank Accuracy Order of Morphemes and the Morpheme Orderings Ranked by External Frequency, Internal Frequency and Increasing Variability

	External Frequency Ordering	Internal Frequency Ordering	Increasing Variability
Group Rank Accuracy Ordering	.75*	.62*	.91**

* $p<.05$; ** $p<.01$.

While it is inappropriate to infer cause and effect based on correlations, it is clear that the orderings are highly similar. In addition, when the three data-specific (i.e. relative accuracy, internal frequency and internal variability) rank orders are compared with each other using a Kendall Coefficient of Concordance, a $W = .857$ ($\chi^2 = 25.73$; $p<.01$) is obtained. That is, the group cross-sectional rank ordering of morphemes by three different methods shows a high degree of concordance. In addition, the internal frequency order for my six subjects parallels the adult (external) frequency ordering (rho = .88; $p<.01$) as Larsen found. It appears then, that frequency (internal and external) and variability, as methods for rank ordering group cross-sectional morpheme scores, may yield an ordering similar to the ordering of morphemes by relative accuracy[3].

I ran the same correlations for the Bailey et al. (1974) data. That is, I compared their group rank accuracy ordering of morphemes with the rank ordering of morphemes according to external frequency, internal frequency, and increasing variability. For this study it seems that while the external frequency order correlates significantly with the group accuracy order, and the increasing variability correlates significantly with the accuracy ordering, internal frequency does not correlate significantly with accuracy. These correlations are displayed in Table 3. Moreover, while my internal frequency order parallels (Brown's) external frequency (rho = .88; $p<.01$), Bailey et al.'s internal frequency ordering does not correlate significantly with the external frequency order (rho = .39, n.s.).

Table 1

Confidence Limits Around the Means of Eleven Morphemes for Six Subjects

	Ing	Aux.	Sh. Pl.	Art.	Cop.	Poss.	Past i.	3rd reg.	Pro.	Past reg.	L. Pl.
Lower Limit	75.11	55.68	80.93	74.01	74.87	31.80	56.40	2.67	76.35	17.93	7.67
Upper Limit	106.88	108.31	101.07	103.98	101.13	116.20	89.60	87.32	102.05	110.07	130.33

Table 4

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Spearman Correlation Coefficients Between the Morpheme Orderings by Internal and External Frequencies for the Rosansky, Bailey et al., and Larsen Studies

	Internal Frequency Orders			
	Rosansky	Bailey et al.	Larsen I	Larsen II
(Brown's) External Frequency Order	.88**	.39	.71*	.71*

*$p<.05$; **$p<.01$.

Table 3

Spearman Correlation Coefficients Between the Group Rank Accuracy Order of Morphemes and the Morpheme Orderings Ranked by External Frequency, Internal Frequency and Increasing Variability, for the Bailey et al. Study

	External Frequency Ordering	Internal Frequency Ordering	Increasing Variability
Group Rank Accuracy Ordering	.71*	.45	.79*

*$p < .05$.

Clearly, something is different about the internal frequency order in the Bailey et al. study. I speculated that the difference may result from the way the data were collected, i.e. my data were based on spontaneous speech and Bailey et. al.'s data were elicited via the BSM. Perhaps the BSM systematically allowed for more productions of some morphemes than of others such that native frequencies may have been obscured. This is apparently not an adequate explanation, since Larsen's internal frequencies on the BSM task did parallel native adult frequencies (Larsen, p.126). To clarify these frequency correlations, the correlations between the internal and external frequency orderings for the three studies are summarized in Table 4.

Since Larsen's data were also based on the BSM, what accounts for the seeming difference in the Bailey et al. study's internal frequency ordering? Their study is similar to Larsen's in several ways: both are based on adults; both samples are comprised of ESL students; both contain subjects from a variety of language backgrounds. The Bailey et al. study is based on more subjects (72 vs. 24), but this shouldn't be a contributing factor here. The Bailey et al. sample contained a broader range of ESL student levels while Larsen's students were more homogeneous, but the more advanced students' frequency orders in the Bailey et al. study should have paralleled the external frequency ordering by virtue of greater exposure to English. Moreover, if growth or additional instruction were affecting the internal frequency orders with respect to the external frequency order, then Larsen's Phase II[4] frequency order should have been different from her Phase I order. As Table 4 indicates, Larsen's Phase I and Phase II internal frequency orders attained the same degree of correlation with the external frequency ordering.

Barring any gross differences in the administration of the BSM task for these two studies, the only apparent difference between the two studies may be the version of the BSM used to elicit the subjects' speech. Bailey et al. conducted their study following Dulay and Burt's 1973 precedents while Larsen refers to Dulay and Burt 1974[5]. This internal frequency difference may add support to the findings I've reported elsewhere (1976a,b) suggesting that Dulay and Burt's own morpheme accuracy orders from the 1973 and 1974 studies did not correlate. However, it should be emphasized that this kind of evidence is merely suggestive.

To summarize the correlations of the various morpheme orderings reported so far: it appears that for all of the cross-sectional studies cited, the group rank accuracy orders of morphemes correlate significantly with native adult relative frequencies. These correlations are summarized in Table 5. In addition:

1. For my study the group rank accuracy order of morphemes correlates with the ordering of morphemes by relative frequency and by increasing variability, as well as with the external frequency order. Furthermore, my group internal frequency order of morphemes parallels the native adult frequency order or morphemes.

2. Bailey et al.'s group rank accuracy order of morphemes correlates with the native adult frequency order and with the ordering of morphemes by increasing variability. The internal frequency ordering correlates neither with the rank accuracy order of morphemes or with the native adult freqenncy ordering of morphemes.
3. Larsen's group accuracy order of morphemes correlates with the ordering of morphemes by relative internal frequency and with the external frequency ordering. In addition, her internal frequency ordering of morphemes correlates with the external frequency ordering.

Interestingly, in spite of the non-significant correlation in the ordering of morphemes by relative accuracy and by internal frequency in the Bailey et al. data, a Kendall Correlation of Concordance W performed for all three orderings of morphemes considered together (i.e. by group ranked accuracy, by internal frequency, and by increasing variability) yields a W = .7936 (χ^2 = 16.66; $p<.02$). That is, the three methods are highly concordant with respect to the relative rankings they assign the morphemes.

What may account for so high a Kendall Coefficient of Concordance is yet a fourth paired correlation, i.e. the comparison between the rank ordering of morphemes by internal frequency and by increasing variability. This correlation for Bailey et al.'s data attains a rho = .857; $p<.01$. I computed a Spearman Rank Order Correlation Coefficient for my morpheme orderings on these same two variables and obtained a rho = .86; also significant at $p<.01$. The high correlations here suggest that the more obligatory occasions the subjects (as a group) provided for a morpheme, the less variable the group data were likely to be. Another way to look at this is to consider that large variability implies a wider range of scores with respect to the Group Mean score for that morpheme. With more obligatory occasions there are not likely to be extreme scores. This is analagous to saying that a large N (sample size) will more likely approximate a normal sampling distribution than a small N. Here the 'sample size' is the number of obligatory occasions provided by the subjects for a morpheme.

In light of the correlations among ordering methods presented thus far, it is difficult to make a generalization regarding the exact nature of the group cross-sectional accuracy orders of morphemes on the basis of what appear to be a number of potentially interacting effects. In addition, the rank ordering by group accuracy is still subject to the variability problems I have previously reported. It thus seems premature to attempt to determine the basis of the group cross-sectional orderings of morphemes. Furthermore, while frequency may be one source or contributing factor in the group cross-sectional orderings, it is still entirely possible that, like the Group Mean scores themselves, the frequency orderings may also be an artifact of grouping.

To check this possibility, I examined my cross-sectional rank ordering of morphemes for each of the six individuals. I computed correlations for each individual subject's rank ordering by morpheme accuracy and his/her rank internal frequency order, and (Brown's) external frequency order. These correlations are summarized in Table 6.

While the group rank accuracy order of morphemes correlates with the rank ordering of morphemes by relative internal frequency and by external frequency, Table 6 reveals that of the six individual rank accuracy orders, for only one subject (Jorge) is there a significant correlation with internal frequency. And none of the individuals' rank accuracy orders correlates significantly with the native adult frequency ordering of morphemes. Thus it appears, based on these six subjects, that while the group cross-sectional accuracy order of morphemes parallels the frequency orders (internal and external), this is in general not the case for

Table 5

Spearman Correlation Coefficients Between the Native Adult (External) Frequency Ordering of Morphemes and the Rank Accuracy Order of Morphemes for the Rosansky, Bailey et al., Larsen, and Dulay and Burt Studies

	Native Adult (External) Frequency Order of Morphemes				
	Rosansky	Bailey et al.	Larsen I	Larsen II	D & B (1974)
Rank Accuracy Order of Morphemes	.75*	.71*	.71*	.90**	.83*[a]

*p<.05; **p<.01.
[a]Reported by Larsen (p.137).

Table 6

Spearman Correlation Coefficients Between Six Individual's Morpheme Rank Accuracy Orders and the Ordering by Individual Internal Frequency and External Frequency

	Marta	Cheo	Juan	Jorge	Alberto	Dolores
	Individual Rank Accuracy Order					
Individual Frequency Order	.116	.523	-.41	.854*	.29	.21
External Frequency Order	.40	.657	-.098	.24	.45	.446

*p<.01.

individuals who comprise the group. As with the correlations among accuracy orders for various studies, ungrouping grouped data presents us with a different picture entirely. While the pooled accuracy ordering may take the same shape as the group frequency orders, and while it may parallel the ordering of morphemes in terms of increasing variability, this is clearly not the case for the individual orders.

Before leaving the frequency ordering to future research, it is of interest to examine the relative ordering of morphemes with respect to accuracy and frequency for longitudinal data. A direct comparison of Jorge's longitudinal acquisition[6] order and Brown's order of native adult frequency is difficult to interpret. There are only four comparable morphemes to rank order since of the six morphemes Jorge acquires (article, short plural, copula, pronoun case, -ing, and auxiliary be), only four are comparable to Brown's morphemes. For an N this small, the Spearman requires an rho = 1.0 for significance at the .05 level. Jorge's longitudinal acquisition order compared with the external frequency order attains a rho = .95 which is not statistically significant at the .05 level.

Table 7 displays the correlations between Jorge's accuracy rank ordering at each one month interval and the rank ordering with respect to his internal frequency and with respect to the external frequencies. Also displayed (the bottom row of figures) are the correlations between Jorge's internal frequency orders and the ranking by external frequency.

There is not a clear developmental trend among the orderings. A weak case could be made for three of the last four months' rank orderings being parallel for accuracy and internal frequency; but in general, there is not an overwhelming similarity between Jorge's accuracy order and the ordering according to internal frequency - or external frequency. Judging from this subject's pattern of development, it appears that Larsen's suggestion that "... one way to explain the [accuracy] orderings is to accept frequency of occurrence as their basis (p.138)," may have been premature. However, it should be remembered that this evidence is based on only one subject; he may be non-representative in some way.

The only apparent effect in Table 7 is the correlations between Jorge's rank ordering of morphemes by internal frequency and the external frequency ordering of the morphemes. For seven of the ten samples, a significant correlation is obtained. One explanation for the frequency order parallels may be not that external frequencies per se have influenced Jorge's acquisition, but simply that in order to speak English, certain morphemes will of necessity have to be produced more frequently than other. (E.g. many NP's require articles while the past regular is not as likely to be part of every VP.)

Once again, what is striking about Jorge's longitudinal data seen as ten one-month points is the extent of variability over time. Not only does the morpheme accuracy fluctuate over time as I've previously reported, but the relative frequency orders of the morphemes fluctuate with respect to the accuracy orders over time. The fluctuation in these correlations, however, may lie in the variability of the accuracy orders alone.

The Kendall Coefficient of Concordance W for the accuracy ordering of the four morphemes for which Jorge had obligatory occassions at each of the 10 points was not statistically significant (W = .204; S = 102). A Kendall Coefficient of Concordance for the internal frequency ordering of these same morphemes (i.e. pronoun case, article, copula, and short plural) with respect to each other over the ten months, is significant (W = .828; S = 414; $p<.01$). Thus for these four morphemes there is a signigicant concordance in their relative rankings with respect to num-

Table 7

Spearman Correlation Coefficients for the Rank Ordering of Jorge's Morphemes by Several Methods at 10 One-month Samples

	Tape Sessions									
	1	3	5	7	9	11	13	16	18	20
	Internal Frequency Ordering									
Relative Accuracy Ordering	.03	.25	.643*	.41	.43	.22	.68*	.85**	.19	.645*
	(Brown's) External Frequency									
	.48	.80	.71	.59	.81*	.57	.684*	.24	.53	.57
Internal Frequency Ordering	.81	1.00*	.94**	.67*	.70	.738*	.69*	.828[a]	.893**	.80*

*$p < .05$. **$p < .01$.

[a] $p < .05 = .829$.

ber of obligatory occasions supplied across the ten months of the study. There is no such concordance for the same morphemes when ranked by relative accuracies in obligatory context.

Thus, relative accuracy on the morphemes from month to month is not paralleled by the relative internal frequency of obligatory contexts provided. Furthermore, while accuracy fluctuates from month to month, relative frequency appears to remain consistent over time, and to parallel native adult freguencies - for this subject.

To summarize: this paper has considered the ordering of morphemes by group accuracy in terms of ordering by internal frequency (i.e. the relative rank number of obligatory occasions supplied by the subjects) and external frequency (i.e. the native adult frequency ordering of morphemes). The correlations between orders are statistically significant, however ordering the morphemes by increasing variability also attains a statistically signigicant correlation with the group performance order.

The rank-ordering-by-frequency explanation runs into difficulty with the individual data however. When the individuals' cross-sectional morpheme accuracy rank orders are examined with respect to internal and external frequency orders, there no longer appears to be a statistically significant relationship.

Finally, the rank-ordering-by-frequency explanation was considered with respect to longitudinal data for a single individual. Once again, the relative accuracy ordering appears not to resemble the frequency ordering.

On the basis of these results it appears that when the commonly examined morphemes are ordered by grouping the performance data, similarities in orders can be found from group to group in terms of relative accuracy, internal frequencies, and increasing variability. These grouped orders also apparently parallel normal native adult frequency orders. When the data are ungrouped and individual performance is examined, the individual accuracy orders do not appear to be similar to the ordering of morphemes by relative native frequency (external frequency). In fact, when a single individual is examined longitudinally, the only striking consistency to emerge is that the relative frequency with which the learner produces the various morphemes correlates highly with the relative frequency with which native adult English speakers produce these same morphemes. Learner frequency orders, like native frequency orders, are probably simply a function of the morphological constraints of English structure.

FOOTNOTES

1 Brown (1973) Table 52, p.358.

2 For details see Rosansky 1976. The study entailed a longitudinal investigation of six untutored Spanish speakers learning English and was carried out over a 10-month period. The cross-sectional part of the study focussed on the six subjects after 10 months of exposure to English.

3 It is of interest to note that for the de Villiers' L_1 study there was not quite a significant correlation between ordering by increasing variability and ordering by relative accuracy of the morphemes (rho = .642). The critical value of rho (p .05) with an N of eight is .643.

4 Phase II data were collected from the same subjects after two months of exposure to ESL instruction.

5 Apparently, the 1974 version of this test contained additional pictures and more questions than the 1973 version.

6 Jorge, a 13 year old Colombian, was one of the six subjects.

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